

A STUDY ON OIL SPILL DETECTION WITH X-BAND MARINE RADAR

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ABSTRACT

In recent years, the international marine transportation industry and sea oil mining industry are developing at a very high speed especially in the rapidly developing countries and regions such as China, India etc. As the expanding of sea oil mining and transport industry, more and more oil spill incidents occurred, which lead to severe damage to marine environment and marine transportation safety, to which draws the international society's attention. The traditional monitoring methods include space borne or air borne remote sensing. But as we know that, satellite has a relatively long revisit period which makes it impossible to implement in time monitoring on oil spill emergency, and the air borne monitoring depends greatly on the weather, climate, visibility or some other factors around the location where incidents occurred and costs a lot. So it is difficult to realize all-weather, day and night continuously monitoring on oil spill incidents.

With the rapid advancement of the radar hardware and data processing software, it has become possible now to monitor and identify oil spill information with common marine radar equipment on board or shore-based. This provides users a low cost, low risk way with wide coverage, real time capability to monitor oil spill on sea..

Wind above the sea surface produce the capillary and gravity wave which has enough energy that could be represented on radar with its peculiar characteristic that is discussed in this paper. Spilled oil film floating on the sea surface will reduce the surface tension of sea water, so the surface with floating oil will be calmer than the area around with no oil or something else, which will make less reflecting energy back to radar receiver, and a relatively black area will be seen on the radar images. Treated as the sum of a large number of harmonic wave component and based on the random-phase/amplitude model, waves can be described as wave spectrum which can be deduced to frequency, wave-number and some other factors. With analyzing the spectrum and texture of radar images, a model on the base of space and time distribution of sea surface wave energy to detect area with oppressed wave by spilled oil is built in this paper.

The X-band marine radar Vision Master FT 250 manufactured by Sperry is selected as the front end facility to obtain the raw radar data. A customized PCI adapter is made to be the middleware between radar and personal computer. A framework of oil spill monitoring system comprised of common and low cost marine radar and personal computer is then be implemented. With the adapter, radar data is processed in accordance with the requirements of detecting floating oil. Different from normal processing of marine radar which is to detect objects like ships or land, the sea clutter which used to be filtered as noise is enhanced here to give the algorithm analyzing wave spectrum energy enough information of sea surface. An adaptive algorithm to automatically determine the threshold used in the sea clutter signal processing is introduced.

Several experiments were done with this customized radar system at China offing. Foam board and several kinds of common oil that often found in oil spill incidents were placed on sea for simulation. Radar images with clear oil area were gotten from this experiment, and with these image data, this system and algorithm mentioned above was tested and validated. The oil spill area is well identified by this system which gives future oil spill monitoring and clearing task an available tool.

Key Word: Oil spill, Marine radar, Wave spectrum

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